

CLAIMS

1. A method for cleaning a surface of a substrate, which comprises at least the following steps (1) and (2), wherein the step (2) is carried out after carrying out
5 the step (1):

Step (1): A cleaning step of cleaning the surface of the substrate with an alkaline cleaning agent containing a complexing agent, and

Step (2): A cleaning step employing a cleaning agent
10 having a hydrofluoric acid content C (wt%) of from 0.03 to 3 wt%, wherein the cleaning time t (seconds) of the substrate with said cleaning agent is at most 45 seconds, and C and t satisfy the relationship of $0.25 \leq tC^{1.29} \leq 5$.

2. The method for cleaning a surface of a substrate
15 according to Claim 1, wherein the complexing agent is a compound having nitrogen as a donor atom, and a carboxyl group and/or a phosphonic acid group.

3. The method for cleaning a surface of a substrate according to Claim 2, wherein the complexing agent is a
20 compound having an aromatic hydrocarbon ring, and at least two OH groups and/or O⁻ groups directly bonded to carbon atoms constituting said ring.

4. The method for cleaning a surface of a substrate according to Claim 3, wherein the complexing agent is one
25 or more selected from the group consisting of ethylenediamine tetracetic acid (EDTA), ethylenediamine di-o-hydroxyphenylacetic acid (EDDHA) and/or its

derivatives, diethylenetriamine pentacetic acid (DTPA), and propylenediamine tetra(methylenephosphonic acid) (PDTMP).

5. The method for cleaning a surface of a substrate according to Claim 1, wherein the concentration of the complexing agent in the cleaning agent used in the step (1) is from 1 to 10,000 wt ppm.

6. The method for cleaning a surface of a substrate according to Claim 1, wherein the cleaning agent used in the step (1) contains ammonium hydroxide.

7. The method for cleaning a surface of a substrate according to Claim 6, wherein the pH of the cleaning agent used in the step (1) is at least 9.

8. An apparatus for cleaning a surface of a substrate, characterized by employing the method for cleaning a surface of a substrate as defined in Claim 1.

9. A method for cleaning a surface of a substrate, which comprises at least the following steps (2) and (3), wherein the step (3) is carried out after carrying out the step (2):

Step (2): A cleaning step employing a cleaning agent having a hydrofluoric acid content C (wt%) of from 0.03 to 3 wt%, wherein the cleaning time t (seconds) of the substrate with said cleaning agent is at most 45 seconds, and C and t satisfy the relationship of $0.25 \leq tC^{1.29} \leq 5$, and

Step (3): A cleaning step of cleaning the surface of

the substrate with an alkaline cleaning agent.

10. The method for cleaning a surface of a substrate according to Claim 9, wherein the cleaning agent used in the step (3) contains a complexing agent.

5 11. The method for cleaning a surface of a substrate according to Claim 10, wherein the complexing agent is a compound having nitrogen as a donor atom, and a carboxyl group and/or a phosphonic acid group.

12. The method for cleaning a surface of a substrate
10 according to Claim 11, wherein the complexing agent is a compound having an aromatic hydrocarbon ring, and at least two OH groups and/or O⁻ groups directly bonded to carbon atoms constituting said ring.

13. The method for cleaning a surface of a substrate
15 according to Claim 12, wherein the complexing agent is one or more selected from the group consisting of ethylenediamine tetracetic acid (EDTA), ethylenediamine di-o-hydroxyphenylacetic acid (EDDHA) and/or its derivatives, diethylenetriamine pentacetic acid (DTPA),
20 and propylenediamine tetra(methylenephosphonic acid) (PDTMP).

14. The method for cleaning a surface of a substrate according to Claim 10, wherein the concentration of the complexing agent in the cleaning agent used in the step
25 (3) is from 1 to 10,000 wt ppm.

15. The method for cleaning a surface of a substrate according to Claim 9, wherein the cleaning agent used in

the step (3) contains ammonium hydroxide.

16. The method for cleaning a surface of a substrate according to Claim 15, wherein the pH of the cleaning agent used in the step (3) is at least 9.

- 5 17. An apparatus for cleaning a surface of a substrate, characterized by employing the method for cleaning a surface of a substrate as defined in Claim 9.